MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

ECE2056 – DATA COMMUNICATIONS AND NETWORKING

(ALL GROUPS)

9 FEBRUARY 2023
2:30 p.m – 4:30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 5 pages including cover page with 4 Questions only.
2. Attempt **ALL** Questions. The distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

Question 1 (25 marks)

(a) Describe the functions of the FIVE (5) layers in the Transmission Control Protocol/Internet Protocol (TCP/IP) model.

[5 marks]

(b) Discuss the advantages of the following concepts in data communication:

(i) Full duplex transmission

[2 marks]

(ii) Byte stuffing

[2 marks]

(iii) Encapsulation process

[2 marks]

(c) Briefly explain the following protocols:

(i) High-level Data Link Control (HDLC) protocol

[4 marks]

(ii) Address Resolution Protocol (ARP)

[2 marks]

(d) A small company wishes to set-up a new network comprising of nine devices. The company would like to get your advice on which network configuration would be suitable if one of the connection fails. For each of the following four options, discuss the consequences if a connection fails:

(i) Nine devices arranged in a mesh topology

[2 marks]

(ii) Nine devices arranged in a star topology

[2 marks]

(iii) Nine devices arranged in a bus topology

[2 marks]

(iv) Nine devices arranged in a ring topology

[2 marks]

Continued...

Question 2 (25 marks)

(a) Channelization is a multiple access method in which available bandwidth of a link is shared among the stations. Briefly describe THREE (3) channelization methods.

[6 marks]

(b) Suppose the length of the cable connecting two computers on a Standard Ethernet Local Area Network (LAN) is 3000 m. Assume that the propagation speed of a signal in the cable is 2×10^8 m/s. Answer the following:

(i) What is the minimum Ethernet frame size?

[2 marks]

(ii) Calculate the propagation delay of the signal, T_p.

[2 marks]

(iii) Calculate the transmission delay T_{fr}, of an Ethernet frame of the smallest possible size.

[2 marks]

(iv) Calculate the number of frames a, that can fit on the cable.

[2 marks]

(v) Calculate the efficiency of the Standard Ethernet in this network.

[2 marks]

(c) A network using CSMA/CD (Carrier Sense Multiple Access with Collision Detection) has a bandwidth of 300 Mbps. The maximum propagation time (including the delays in the devices and ignoring the time needed to send a jamming signal) is 12.8 μs. What is the minimum size of the frame in bytes?

[3 marks]

(d) Describe TWO (2) strategies used in CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) to avoid collision.

[6 marks]

Continued...

Question 3 (25 marks)

(a) Discuss the differences between classful addressing and classless addressing in IPv4.

[4 marks]

(b) In an IPv4 packet, the value of the HLEN is 1100 in binary. How many bytes of OPTIONS are being carried by the packet?

[3 marks]

(c) In a block of addresses, the IP address of one of the hosts is given as 171.65.44.15/25.

(i) What is the number of host addresses available in the network?

[1 mark]

(ii) Determine the first address in the network.

[4 marks]

(iii) Determine the last address in the network.

[4 marks]

(d) An organization with a Class B address of 166.99.0.0 requires at least 7 subnets. Determine the maximum number of hosts in a subnet, and find the subnet mask needed. How many remaining subnets can the company utilized?

[7 marks]

(e) Simplify the IPv6 address of 2350:1ABC:0000:0000:C000:0011:019A:0000 using Leading Zero Compression method.

[2 marks]

Continued...

Question 4 (25 marks)

(a) A packet has arrived in which the offset value is 200 and the payload size is 300 bytes. What are first byte number, and last byte number, respectively?

[2 marks]

(b) Assume that we need to design a Selective-Repeat sliding window protocol for a network in which the bandwidth is 2 Gbps and the average distance between the sender and receiver is 500 km. Assume the average packet size is 1000 bits and the propagation speed in the media is 2×10^8 m.

(i) Find the bandwidth-delay product.

[2 marks]

(ii) Find the maximum size of the send and receive windows.

[2 marks]

(iii) Find an appropriate time-out value for the timer. Justify your answer.

[3 marks].

(c) In a Go-Back-N sliding window protocol, given that the sliding window size is 8. Draw the timing diagram between sender and receiver in a single diagram for the following scenarios:

(i) The first 2 packets had been sent and acknowledged.

[3 marks]

(ii) The 3rd and 4th packets received by the receiver and the acknowledgement packets were sent. However, the 3rd acknowledgement packet is lost during its transmission. Show and explain what happened to both received packets.

[4 marks]

(iii) The 5th and 7th packets are sent. However, the 5th packet is lost during its transmission. Show and explain what happened to all these packets.

[4 marks]

(d) Simple Mail Transfer Protocol (SMTP) is the protocol used in sending electronic mail. Discuss in detail why SMTP uses Transmission Control Protocol (TCP) as its transport protocol rather than using User Datagram Protocol (UDP).

[5 marks]

End of Paper